INTRODUCTION

BACKGROUND

Since 1986, and every two years thereafter, the National Science Foundation (NSF) has collected data on issues related to science and engineering research facilities in U.S. colleges and universities. The Survey of Scientific and Engineering Research Facilities at Colleges and Universities, which is co-sponsored by the National Institutes of Health (NIH), provides information on the availability and condition of S&E research space, the extent to which colleges, universities, nonprofit biomedical research organizations, and research hospitals construct facilities and repair existing space, the funding of this activity, and the need for additional S&E research space.

The impetus for this effort stems from hearings held in both the U.S. House of Representatives and the Senate in the mid-1980s. These hearings concluded that the condition of S&E research facilities in our Nation's higher education institutions posed a "serious and ongoing problem." Very little data were available to evaluate either the extent of the problem or the likelihood of the problem continuing.

Recognizing the need for information on the amount and quality of S&E research space, Congress mandated NSF to collect this information and report it to Congress:

> *The National Science Foundation is authorized to design, establish, and maintain a data collection and analysis capability in the Foundation for the purpose of identifying and assessing the research facilities needs of universities and colleges. The needs of universities by major field of science and engineering, for construction and modernization of research laboratories, including fixed equipment and major research equipment, shall be documented. University expenditures for the construction and modernization of research facilities, the sources of funds, and other appropriate data shall be collected and analyzed. The Foundation, in conjunction with other appropriate Federal agencies, shall report the results to the Congress. The first report shall be submitted to the Congress by September 1, 1986 (42 U.S.C. 1886).*

NSF submitted the first report to Congress in 1986, and additional reports were submitted every two years thereafter. In each of those years, surveys were conducted to provide NSF with the information Congress requested. The 1998 report summarizes the findings of the 1998 survey, and it compares results with previous survey cycles.

THE SURVEY AND ITS DESIGN

The 1998 Survey of Scientific and Engineering Research Facilities at Colleges and Universities collected data to address a number of questions regarding S&E research space, including:

- How much S&E research space is available in our Nation's colleges, universities, nonprofit biomedical research organizations, and research hospitals?
- Is the current amount of S&E research space sufficient?
- What is the condition of existing S&E research space?
- To what extent are colleges, universities, nonprofit biomedical research organizations, and research hospitals constructing S&E research space?
- To what extent are colleges, universities, nonprofit biomedical research organizations, and research hospitals repairing and renovating their existing S&E research space?
- Where is funding for the construction and repair of S&E research space coming from?
- How much additional S&E research space is needed and how much existing space needs to be repaired or renovated?

Since the survey was initiated in 1986, attention has focused on providing Congress with trends on S&E research facilities issues. Slight changes have been made to the survey in each of the data collection cycles. In 1998, for the first time, institutions were asked to estimate

their financial commitments to nonfixed equipment costing $1 million or more in S&E construction and repair/renovation projects. Institutions were also asked to identify the amount of indirect costs recovered from Federal grants and/or contracts that was included in "institutional funds."

In addition, the 1998 survey modified the wording of some questions as well as some possible response options. These changes were made in response to new concerns of NSF as well as concerns of institutional respondents and advisory panel members representing the higher education community. (Specific changes are noted at the beginning of each chapter.)

Academic Institutions

The sample for the 1998 survey was designed to provide efficient and unbiased estimates of the amount of S&E research space in colleges and universities and to retain comparability with the 1992, 1994, and 1996 sampling procedures. The 1998 sample, like the 1996 sample, represents all institutions with more than $50,000 in research and development (R&D) expenditures as well as Historically Black Colleges and Universities (HBCUs) with any R&D expenditures. In addition, the 1998 sample included for the first time non-HBCU-Black institutions and Hispanic-serving institutions (HSIs) with any R&D expenditures. At these institutions, undergradutate enrollment was at least 25 percent of the respective minority populations. The final 1998 sample of 350 colleges and universities represents the universe of 660 research-performing academic institutions. (See Appendix A, "Technical Notes," for a more complete discussion of sampling procedure.) The sample included the following types of colleges and universities:

- All of the top 100 colleges and universities in terms of R&D expenditures (n=100);
- Other public, doctorate-granting universities (n=47);
- Other private, doctorate-granting universities (n=42);
- Public, nondoctorate-granting institutions (n=41);
- Private, nondoctorate-granting institutions (n=41);
- HBCUs that have been in the sample since 1988 (n=29);
- Additional HBCUs (n=28);
- Non-HBCU-Black institutions (n=13); and
- Hispanic-serving institutions (n=9).

The 1998 survey was mailed to all sampled institutions in February 1998. The Windows-based disk version of the survey, which had been developed for the 1996 survey, was converted to an Internet survey. Survey Coordinators received both a paper copy and Internet Survey Instructions, including a log-in name and password, in the survey mailing.

Institutions that participated in the 1996 survey also were sent a computer-generated "facsimile" of their previous responses. Extensive telephone follow-up elicited a high response rate and reduced the number of items that respondents had initially omitted or responded to inconsistently. In all, 304, or 87 percent of all sampled institutions completed the survey. Of those, 160, or 53 percent responded via the Internet and 47 percent filled out the paper version of the survey.

Research Organizations and Hospitals

A sample of nonprofit biomedical research organizations and research hospitals that received extramural research funding from NIH in fiscal year 1997 was also drawn. The final sample included 49 hospitals and 46 research organizations. They represent the universe of 125 hospitals and 171 nonprofit research organizations. These institutions, along with academic institutions that had research space in the biomedical sciences, are referred to as "biomedical institutions" throughout this report.

Survey packets were mailed to the NIH survey coordinators at each site on a rolling basis, beginning in June, 1998. The survey packets included a cover letter, the questionnaire, a facsimile copy of their 1996 survey responses, and instructions for using the Internet survey with their unique log-in password. In all, 87 percent of the sample of nonprofit research organizations and research hospitals completed the survey. Of those, 45, or 54 percent responded via the Internet and 46 percent filled out the paper version of the survey.

THE REPORT

Each chapter in the 1998 report is structured as follows:

- ***Highlights***—a summary of key findings;
- ***Introduction***—a rationale for the chapter with a description of the question or questions that the chapter focuses on along with a brief discussion of data limitations or interpretations; and
- ***Findings***—a discussion of the current situation, changes since the first survey period for which data were available, and changes since the last survey period, along with supporting tables and figures.

Most chapters present differences by type of institution and S&E field. The categories used to define type of institution in Chapters 1 through 8 are:

- Doctorate-granting, which includes
  - The top 100 institutions in R&D expenditures
  - The other doctorate-granting institutions not in the top 100
- Nondoctorate-granting

This survey and report, includes the following S&E fields:

- Engineering
- Physical sciences
- Earth, atmospheric, and ocean sciences
- Mathematics
- Computer sciences
- Agricultural sciences
- Biological sciences outside medical schools
- Biological sciences in medical schools
- Medical sciences outside medical schools
- Medical sciences in medical schools
- Psychology
- Social sciences

Chapter 1 presents findings on the amount of research space in S&E fields at research-performing institutions. Chapter 2 examines assessments of the adequacy of the amount of existing S&E research space relative to current research commitments, as well as its condition. Chapter 3 provides costs for new S&E research facilities construction projects. Similarly, Chapter 4 provides costs for new S&E research facilities repair/renovation projects. Chapter 5 examines the sources of funds for the capital projects described in Chapters 3 and 4.

Chapter 6 examines institutions' need for additional S&E research space, as well as their need for the repair/renovation of existing space. Chapter 7 profiles S&E research space at minority-serving institutions. Chapter 8 presents data on animal research facilities.

The final chapter, Chapter 9, assesses the amount, quality, and condition of research facilities in the Nation's biomedical research-performing institutions. These are institutions with research space in the biological or medical sciences inside or outside of medical schools. The categories used to define types of institutions are:

- Academic institutions
  - Colleges and universities
    - The top 50 institutions in R&D expenditures
    - The other doctorate-granting institutions not in the top 50
    - Nondoctorate-granting institutions
  - Medical schools
- Nonprofit research organizations
- Research hospitals

There are six appendices:

- Appendix A, "Technical Notes," presents additional details about the study design and methodology;
- Appendix B, "List of Sampled Institutions," provides the names of all the academic institutions, nonprofit biomedical research organizations, and research hospitals in the sample;

- Appendix C, "Survey Questionnaire," provides the paper copy of the 1998 survey instrument;
- Appendix D, "Reference List," contains the full citation for all references used in this report;
- Appendix E, "Detailed Statistical Tables," presents additional tables not included in the chapters; and
- Appendix F, "Glossary," presents explanation of terms and phrases used in this report.

Data Considerations

Data collection for this report took place in early 1998. Information about new construction and repair/renovation projects was collected for fiscal years 1996 and 1997. Information about the amount, quality, and condition of S&E research space is reported in terms of its status at the time the survey was completed (1998). Information about construction and repair/renovation projects scheduled for the next two fiscal years is reported for 1998 and 1999. Net assignable square feet (NASF) is the measure of space used in this report. It is the sum of all areas, in square feet, on all floors of a building assigned to, or available to, an occupant for specific use.

It should be noted that the Survey of Scientific and Engineering Research Facilities only collects information on the total NASF of science and engineering research space and the total amount of dollars colleges, universities, nonprofit biomedical research organizations, and research hospitals commit to all S&E construction and repair/renovation projects costing over $100,000 in each of the S&E fields. The Facilities Survey does *not* collect data on the total gross square footage or the cost of construction or repair/renovation of *buildings*. (See Appendix A, "Technical Notes," for further information on how NASF and the cost of construction and repair/renovation projects were prorated.)

Tables that report costs or funds committed over time are presented in constant 1997 dollars, with current dollar tables found in Appendix E. The 1994 report was the first report to present trends in constant dollars. Thus, constant dollar figures in the reports from 1994 on cannot be compared directly. (Refer to Appendix A for more detailed discussion of the inflator and price index.) In addition, tables that analyze differences among S&E fields have been limited to only those institutions that have research space in those fields.

In order to control for sampling error, this year for the first time, all trend data and group differences were analyzed using a 95-percent confidence interval. Note that because of the small sample size of nondoctorate-granting institutions and research hospitals, and the often small sample size of institutions with research space in some of the science and engineering fields, what appear to be large year-to-year changes are often not statistically distinguishable because of the large sampling error associated with them. In addition, a coefficient of variation of 25 percent or less was allowed. Consequently, any change between the current survey period and any prior one that fell within the 95-percent confidence interval or whose coefficient of variation was greater than 25 percent is not discussed. Also not discussed are differences between prior time periods (e.g., 1992 compared with 1994), because the confidence interval data for those time periods were unavailable.

Taken as a whole, the information prepared for this report will shed light upon the amount, quality, and condition of science and engineering research space in the Nation's colleges, universities, nonprofit biomedical research organizations, and research hospitals.